HexPly® M35-4

80 - 180°C curing epoxy matrix

Product Data

Description

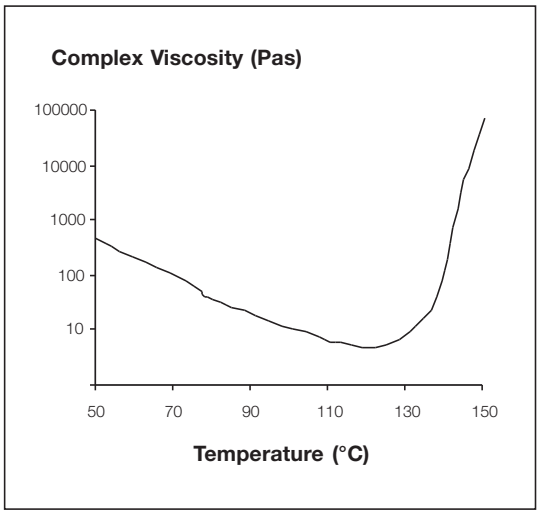
HexPly® M35-4 is a toughened epoxy matrix with excellent mechanical and temperature performances combined with wide process flexibility, designed specifically for the high performance car industry. Curing temperature ranges from 80–180°C providing process flexibility.

Benefits and Features

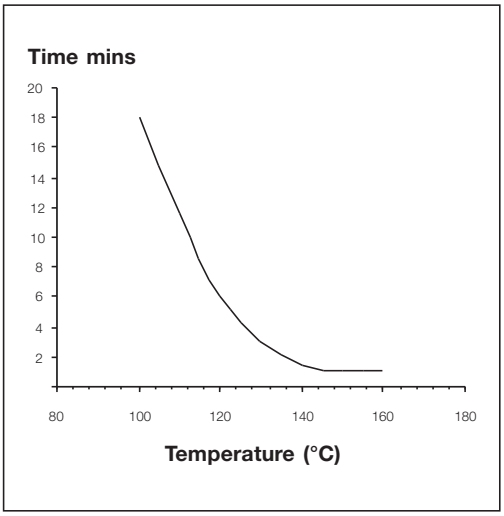
- Cure temperature 80 – 180 °C
- Elevated temperature performance : Tg and service temperature
- Cured using a variety of processes (press, autoclave and vacuum)
- Optional post-cure
- Excellent drape and tack
- Long shelf life and out-life

Resin Matrix Properties

Rheology



Gel time

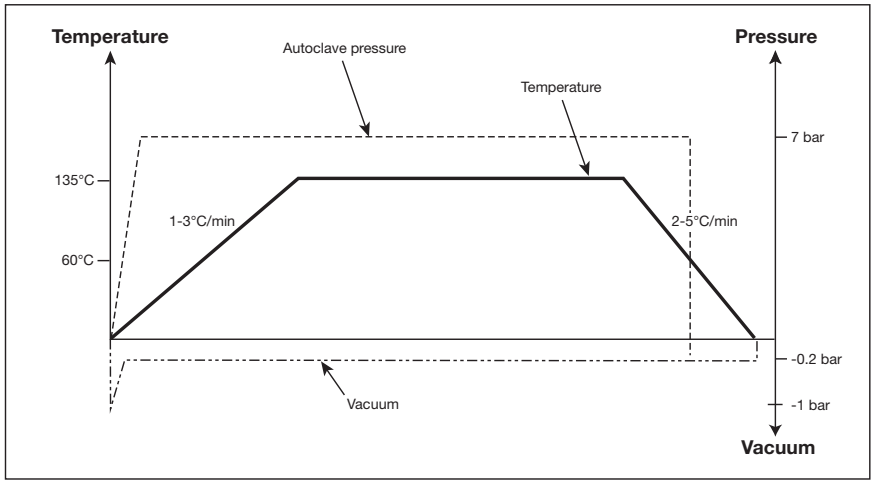


Curing Conditions

HexPly® M35-4 is a flexible curing system and can be cured at temperatures from 80 to 180°C, using a variety of curing processes including autoclave, press, and vacuum bag/oven cure.

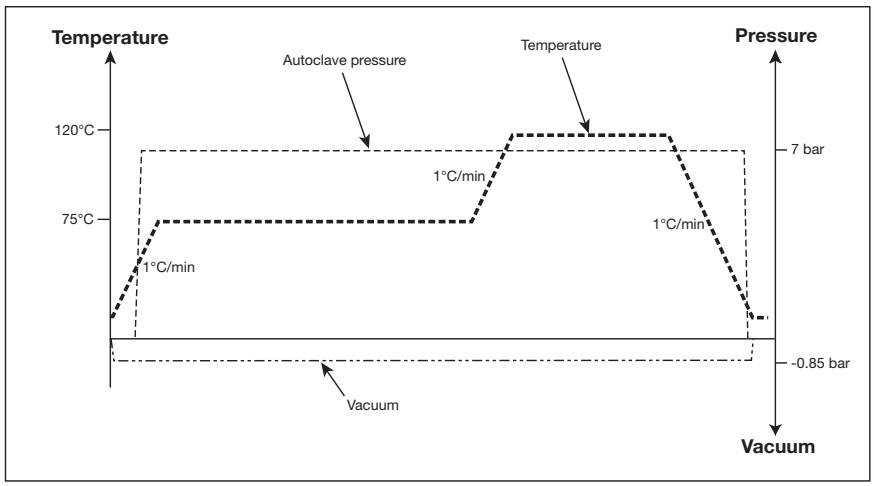
A typical autoclave cure cycle for a thin monolithic laminate is 90 minutes at 135°C.

(1) Apply full vacuum (1 bar).
(2) Apply 7 bar gauge autoclave pressure.
(3) Reduce the vacuum to a safety value of 0.2 bar when the autoclave pressure reaches approximately 1 bar gauge.
(4) Heat-up at 1 – 3 °C/minute to 135°C ± 5°C.
(5) Hold at 135°C ± 5°C for 90 minutes ± 5 minutes.
(6) Cool at 2 – 5 °C per minute.
(7) Vent autoclave pressure when the component reaches 60°C or below.



A typical autoclave cure cycle for a thick (> 10mm) monolithic laminate is 180 minutes at 120°C.

(1) Apply -0.85 bar vacuum.
(2) Apply 7 bar gauge autoclave pressure when the autoclave temperature reaches approximately 45°C.
(3) Heat-up at 1°C/minute to 75°C ± 5°C.
(4) Hold at 75°C ± 5°C for 360 minutes ± 5 minutes.
(5) Heat-up at 1°C/minute to 120°C ± 5°C.
(6) Hold at 120°C ± 5°C for 180 minutes ± 5 minutes.
(6) Cool at 1°C per minute.
(7) Vent autoclave pressure when the component reaches 60°C (140°F) or below.



These cure cycles can be followed by a free-standing post-cure for 2 hours at 180°C to achieve a higher glass transition temperature.

Heat-up rates are dependent on component thickness, eg, slow heat-up rates should be used for thicker components and large tools. Accurate temperature measurements of the component should be made during the cure cycles by using thermocouples. For a honeycomb sandwich panel, a cure pressure of 1 – 3 bars should be used, dependent on honeycomb density.

HexPly® M35-4 is designed for process flexibility and alternative cure cycles can be used.

Cure temperature (°C)	Time
80	12 hours
100	4 hours
120	90 minutes
140	60 minutes
150	30 minutes

Performance testing should be done for alternative cure cycles to ensure suitability for the particular application.

Cured Prepreg Physical Properties

		M35-4/38%/ UD150/CHS/460	M35-4/38%/ 193P/CHS-12K	M35-4/38%/ 245T2/CHS-3K	M35-4/42%/ 385T2/CHS-12K
Fibre Weave Mass	 g/m^2	HS Carbon 24K UD 150	HS Carbon 12K Plain weave 193	HS Carbon 3K Twill 2x2 245	HS Carbon 12K Twill 2x2 385
Nominal Cured Ply Thickness	mm	0.154	0.2	0.255	0.398
Nominal Fibre Volume	%	53.4	53.7	54.0	53.7
Nominal Laminate Density	g/cm^3	1.57	1.56	1.55	1.54

Cured Prepreg Mechanical Properties

Mechanical properties are based on 135°C cure for 90 minutes at 7 bar pressure and 0.9 bar vacuum + PC 120 minutes at 180°C.

Data is the result from several tests on autoclave cured laminates. Some of the values achieved will have been higher, and some lower than the figure quoted. These are nominal values.

Test	Units	Method	Temp °C	M35-4/38%/ UD150/CHS/460	M35-4/38%/ 193P/CHS-12K	M35-4/38%/ 245T2/CHS-3K	M35-4/42%/ 385T2/CHS-12K
Tensile Strength	MPa	EN2561	23	2000	980	950	880
Tensile Modulus	GPa	EN2561	23	142	65	67	62
Flexural Strength	MPa	EN 2562	23	1700	1030	990	850
Flexural Modulus	GPa	EN 2562	23	117	55	55	50
ILSS	MPa	EN 2563	23	95	60	65	47
Compression Strength	MPa	EN 2850B	23	1550	830	900	830
Compression Modulus	GPa	EN 2850B	23	-	-	-	55

NB : Data normalised to Vf = 55% for fabrics and 60% for UD, except for ILSS and Flexural.

Effect of cure cycle and post-cure on glass transition and ILSS properties

Cure Cycle	Tg Onset °C	Tan δ °C	Plus Post-Cure cycle	Tg Onset °C	Tan δ °C
4 hours @ 100°C	100	122	2 hours @ 180°C	195	219
90 minutes @ 120°C	125	145	2 hours @ 180°C	200	223
90 minutes @135°C	138	163	2 hours @ 180°C	206	230
60 minutes @140°C	149	-	2 hours @ 180°C	199	220
30 minutes @150°C	160	-	2 hours @ 180°C	199	221

Results after an autoclave cure. Tg measurements made on Rheometrics DMTA Mark III, Heat-up rate 5°C/min.

Prepreg Storage Life

- Outlife @ 23°C 60 days
- Guaranteed Shelf Life @ -18°C 12 months minimum

Definitions:

Out Life: The maximum accumulated time allowed at room temperature between removal from the freezer and cure.

Shelf Life: The maximum storage life for HexPly® Prepreg, when stored continuously, in a closed moisture proof bag, at -18°C (0°F). To accurately establish the exact expiry date, consult the box label.

Storage Conditions

HexPly® M35-4 prepregs should be stored as received in a cool dry place or in a refrigerator. After removal from refrigerator storage, prepreg should be allowed to reach room temperature before opening the polythene bag, thus preventling condensation. (A full reel in it's packaging can take up to 48 hours).

Precautions for Use

The usual precautions when handling uncured synthetic resins and fibrous materials should be observed, and a Safety Data Sheet is available for this product. The use of clean, disposable, inert gloves provides protection for the operator and avoids contamination of material and components.

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For More Information

Hexcel is a leading worldwide supplier of composite materials to aerospace and other demanding industries. Our comprehensive product range includes:

- Carbon Fibre
- RTM Materials
- Honeycomb Cores
- Carbon, glass, aramid and hybrid prepregs
- HexTOOL® composite tooling material
- Structural Film Adhesives
- Honeycomb Sandwich Panels
- Engineered Core
- Reinforcement Fabrics

For US quotes, orders and product information call toll-free 1-800-688-7734

For other worldwide sales office telephone numbers and a full address list please go to:

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